

REMARKS

The Examiner has rejected claims 32, 33, and 94 are under 35 U.S.C. §103(a) as being unpatentable over combinations of references that include Yao et al, U.S. Patent No. 6,051,114 ("Yao"); Yasar et al. U.S. Patent Application Publication No. 2003/0034244 ("Yasar"); and Hori U.S. Patent No. 6,255,177 ("Hori").

Applicants wish to thank Examiner for the courtesy extended during the telephone interview with Applicants' representative of March 17, 2010. Discussions during the interview were directed to pending claims 33 and 94 and possible amendments that would lead to an allowance. It was determined that amending claim 33 to state that the method of operating the deposition system is for depositing a barrier layer onto a dielectric layer on a substrate may be allowable.

In that regard, Applicants respectfully submit herewith amendments to claims 33 and 94 with cancellation of claim 32. Additional dependent claims have also been added that are directed to specific features of one or more embodiments disclosed by Applicants. Claim 33 now recites that the substrate includes a dielectric layer having "a field area and a plurality of features formed therein and each of the plurality of features including a sidewall, a bottom surface, and an opening" and that the LND and NND deposition process steps deposit a barrier layer onto the plurality of features.

It is noted that the recitation of "ruthenium" in the independent claims was not discussed during the interview, so its patentable weight accorded by Examiner is uncertain. Accordingly, it has been moved to a dependent claim. It is believe that the added reference to a barrier layer is sufficiently limiting. However, if Examiner requests that ruthenium remain in the independent claims, Applicants will consider approving an Examiner's amendment.

Claim 94, as amended, now states that the substrate with a dielectric layer that includes "a field area and each of the plurality of features having a sidewall, a bottom surface, and an opening, wherein the plurality of features of the dielectric layer have a ruthenium barrier layer deposited

thereon" and that the method includes performing an iPVD process of depositing a seed layer onto the ruthenium barrier layer of the features within the dielectric layer.

As Applicants' representative and Examiner discussed during the interview, the pending claims are directed to iPVD deposition processes for depositing a barrier layer (or seed layer in claim 94) into the features of a dielectric layer on a substrate. The cited Yao reference is therefore not applicable. That is, the cited portions of Yao (Col. 6, Lines 3-28) are directed to the filling of the vias with a metal plug and as shown in FIGS. 3C and 3D. Applicants submits that Yao is able to utilize the tailored target power to achieve sputtering of metal onto the field with simultaneous removal of the metal because there is a previously deposited barrier layer 44 and a previously deposited seed layer 50, neither of which is deposited by a simultaneous deposition and etch process. (*Id.* FIGS. 3A-3B) Instead, Yao illustrates a pulsed DC waveform that is applied to the substrate bias and which effectively creates a sequential deposition and etch process. (*Id.* at FIG. 3B; Col. 5, Lines 10-55). In this way, Yao deposits a layer of metal onto the softer dielectric layer before initiating their simultaneous deposition and etch process that would otherwise damage the underlying dielectric layer.

By contrast, Applicants' claims are directed to a slow, net deposition process where material is simultaneously deposited and etched in a manner without damaging the dielectric layer containing the features. Further, by controlling the deposition process by simultaneously depositing and etching, the creation of the overhang is controlled, and not etched away as in Yao and Yasar. A more detailed discussion of Applicants' simultaneous process may be found in the Amendment with Filing of RCE dated November 30, 2009.

Yao does not teach a simultaneous deposition and etch process that deposits a thin layer material onto a dielectric layer as a barrier layer (claim 33) or onto a ruthenium barrier layer as a seed layer (claim 94). As a result, there is at least one unresolved difference between the claimed invention and the Yao reference. Applicants request Examiner's withdrawal of the §103 refusal of these claims.

For the sake of completeness, Applicants will briefly address the Yasar reference. As provided in much greater detail in Applicants' prior responses and amendments, Yasar is a sequential deposition and etch process. The deposition of material into the feature is not controlled – instead overhangs are formed and subsequently etched back. As a result, at least one unresolved difference remains when comparing the claimed invention and the teachings in Yasar. Applicants request allowance of pending independent claims 33 and 94, as well as those claims that depend on these claims.

Regarding the Hori reference, Applicants direct the Examiner's attention to the previously filed responses.

In view of these amendments, and as provided in the detailed response herein, Applicants respectfully submit that pending claims 33 and 94 are in a complete state for allowance. Applicants further submit that new claims 112-121, which depend on one of claim 33 or claim 94 and therefore include all of the same elements therein, are also in a state for allowance.

In view of the foregoing amendments to the claims and remarks given herein, Applicants respectfully believe this case is in condition for allowance and respectfully requests allowance of the pending and new claims. If the Examiner believes any detailed language of the claims requires further discussion, the Examiner is respectfully asked to telephone the undersigned attorney so that the matter may be promptly resolved. The Examiner's prompt attention to this matter is appreciated.

Application No. 10/811,326
Amendment dated May 12, 2010, in response to
Non-Final Office Action mailed February 17, 2010

Applicants are of the opinion that no fee is due as a result of this Amendment. If any additional charges or credits are necessary to complete this communication, please apply them to Deposit Account No. 23-3000.

Respectfully submitted,

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